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**Journal of Transportation Management**

Volume 26 | Issue 2

Article 4

1-1-2016

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## Recommended Citation

Garver, Michael S., Williams, Zachary, Goffnett, Sean P., & Gibson, Brian J. (2016). Parcel shipping: Understanding the needs of business shippers. *Journal of Transportation Management*, 26(2), 29-46. doi: 10.22237/jotm/1451606580

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# **PARCEL SHIPPING: UNDERSTANDING THE NEEDS OF BUSINESS SHIPPERS**

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## **ABSTRACT**

Research on carrier selection addresses how shippers choose carriers. To date, this extensive research stream has not adequately addressed a known and significant shipping segment: business parcel shippers. In this research, input from 374 business parcel shippers was captured and analyzed using Maximum Difference Scaling. The respondents were asked to evaluate the importance of 17 carrier selection variables in regard to choosing a parcel carrier. The overall results indicate that delivery promises, transit times, rates, pick-up promises, and tracking are the most important attributes when a parcel shipper makes a carrier selection. In addition, the results of attribute importance were used to classify the parcel shippers into four unique segments.

## **INTRODUCTION**

The parcel shipping market, which is commonly characterized as shipments of up to 150 pounds (Burks et al., 2004), has grown substantially over the last decade. Data from the Commodity Flow Survey, issued by the U.S. Census Bureau in conjunction with the U.S. Department of Transportation, reveals that in the ten year period from 2002 to 2012, the parcel mode of transportation grew by 59% to nearly \$1.6 trillion worth of goods shipped between U.S. businesses (2013; 2010). Comparatively, over the past 25 years, the parcel shipping industry has greatly outperformed the less-than-truckload (LTL) industry in terms of growth (Jindel, 2010).

Three primary factors have driven the substantial growth of the parcel shipping industry. First, U.S. retail e-commerce sales grew by 406% to \$224 billion between 2002 and 2012, greatly expanding the need for parcel shipping (U.S. Department of Commerce, 2013). Second, changes to manufacturing and inventory processes have created increased volume of smaller, more frequent parcel deliveries. Finally, parcel carriers have increased their maximum shipment weights from 70 pounds to 150 pounds

and developed pricing innovations to convert LTL freight (Haber 2013; Jindel 2010).

Although the parcel shipping market has grown substantially, academic research on this topic has not. Carrier selection research is one of the most researched topics in logistics (e.g., McGinnis, 1979; Abshire & Premeaux, 1991; Voss et al., 2006). Yet, in this wide stream of research, business parcel carrier selection has received almost no attention. This dearth of research is a problem for a number of reasons. First, the size and growth of the parcel shipping market is substantial. Second, academic research has suggested that carrier selection is specific to the mode (truckload or TL, LTL, etc.), as each mode's customers likely have their own unique needs (Kent et al., 2001). Without a better understanding of the specific needs of parcel shippers, parcel carriers cannot develop the best service solutions for their customers.

The purpose of this research study is to examine the preferences and characteristics of business parcel shippers. More specifically, the study will answer the following questions:

1. What is the relative importance of carrier selection variables that business parcel shippers consider when choosing a parcel carrier?
2. Based on the importance of selection variables, can business parcel shippers be segmented according to the importance of these variables?

To pursue answers to these research questions, a brief literature review of parcel shippers and carriers is presented. Next is a discussion of the research design and method employed in this study, followed by a presentation of the results. This is followed by the discussion and implications. Finally, future research and study limitations are presented.

## **LITERATURE REVIEW**

At the outset of the study, a literature review of parcel markets was undertaken to understand the respective requirements of parcel shippers and capabilities of parcel carriers. This effort revealed a dearth of parcel research relative to the number of studies focusing on LTL and TL transportation. Within the parcel sector, the research highlights the growing demand for parcel transportation. Less attention has been paid to shipper needs or carrier service offerings.

### **Parcel Shipping Demand Drivers**

Shipping methods are often dictated by a firm's operational strategies and the purchasing practices of buyers. In the case of parcel shipping, changes in the way goods and services are produced and distributed contribute to the growing importance of this method. In particular, the adoption of lean inventory principles, the use of just-in-time (JIT) manufacturing and customized mass production, and the dramatic growth of e-commerce activity are key contributors to the growth of parcel shipping (Morlok et al., 2000).

In a lean operating environment, excessive inventory is considered waste (Liker, 2004; Vokurka and Lummus, 2000). A major

challenge is the trade-off between decreased inventory levels due to small batch sizes and increased transportation costs resulting from frequent deliveries (Chen and Saker, 2010). To lower total cost in a lean operation, managers must allow for trade-offs between inventory, material handling, storage, transportation, etc. Thus, managers are likely to ship smaller batches using parcel carriers or work with freight forwarders and consolidators (Myerson, 2012).

Arcelus and Rowcraft (1993) highlighted the link between the JIT manufacturing movement and an increased need for parcel shipments. JIT is an order pull system based on actual demand and consumption that attempts to minimize inventory levels and shorten lead times. As a result, smaller, more frequent orders are required and firms become much more reliant on rapid replenishment and expedited delivery, capabilities that parcel carriers excel in. Similarly, one-off production of personal computers, footwear, and clothing drives direct delivery to end users (Andrews, 1998). Again, parcel shipping is a logical delivery solution.

The evolution of consumer buying practices has led to significant growth in parcel shipping activity. Christopher Jr. (2011) notes that e-commerce has been the fastest growing trade sector since 1999 and was largely unaffected by the global economic downturn. At the height of the recession in 2009, e-commerce activity actually increased, allowing many parcel carriers to remain profitable (Andrews, 2011). US retail e-commerce sales reached \$263 billion in 2013 and will continue to increase at an annual rate of 13.7% through 2017, when sales are expected surpass the \$440 billion mark (emarketer, 2014). This growth has driven demand for parcel transportation, to the point of taxing the carriers' network capacity during peak holiday demand (Stock, 2013).

Although heavy attention has been given to the rapid growth of business-to-consumer (B2C) e-commerce activity, it is a fraction of business-to-business (B2B) e-commerce activity. Laudon

and Traver (2012) expect a \$1.1 trillion increase in B2B e-commerce sales, rising from \$3.3 trillion in 2011 to \$4.4 trillion in 2015. This growing B2B activity is further driving demand for parcel shipping service and is leading to rate increases in the form of higher minimum charges (Burnson, 2014).

Finally, changing retail strategies are fueling parcel transportation's growth. Subscription based services like Amazon Prime allow consumers and small businesses to place small orders without incurring charges for second day delivery (Anderson, 2014). A strategic shift to smaller store sizes with lower in-store SKU variety drives the need for home delivery of SKUs that are offered only online (Gustafson, 2014). And, liberal e-commerce return policies with free shipping lead to high return rates which Sarkis et al. (2004) estimate at greater than 30%.

### **Parcel Shippers' Needs**

Recent research purports to show the need for carriers to focus on shipper's most important needs (e.g., Dobie 2005). Understanding shipper needs is a key prerequisite for carriers to develop, implement, and refine customer driven strategy (LeMay, 1986; Coulter et al., 1989 Lambert et al., 1993). Despite the growing activity and importance of the parcel shipping market, the literature review yielded only two research studies that specifically focused on the needs of parcel shippers.

Ding, et al. (2005) developed a fuzzy multi-criteria decision-making model to support the selection of suitable Taiwanese courier service providers. Six primary criteria were included: speed and reliability; freight rates; safety; sales staff; service and convenience; and, carrier considerations. Thirty sub-criteria of interest to parcel shippers were used by this model to systematically appraise and rank four parcel carriers.

Lin and Lee (2009) identified seven factors that are important in choosing parcel carriers when

firms and consumers are selling products in an online environment. The researchers found that the following factors were important when choosing a parcel carrier:

- On-time, tracking, and quick response,
- Fare rate and freight loss,
- Security and reputation,
- Personnel courtesy and quality,
- Equipment, package, and flexible service,
- Diversified service,
- Promotion and reputation.

These studies took important steps in identifying parcel shipping customers as a known and unique segment of the transportation market. The current research seeks to extend the prior research and further answer questions regarding the needs of parcel shippers.

### **Parcel Carriers' Capabilities**

Much academic literature has been focused on various motor carrier markets, including LTL (Jarrah et al., 2009; Lin et al., 2009; Barcos et al., 2010; and Hernandez et al., 2011) and truckload (TL) (Kent and Smith, 2005; Ergun et al., 2007; Liu et al., and 2010; Pai, 2011). However, many distinct differences exist for motor carriers that operate in the parcel environment that necessitates independent study of this market segment.

Parcel shipping has been hailed by Morlok et al. (2000) as a major element of the U.S. transportation system that is essential to modern commerce. From a service standpoint, these authors state that parcel carriers are at the forefront of modern transportation services. Parcel carriers are industry leaders due to their differentiated time-definite service options, intermodal service, in-transit visibility, and data integration with the management systems of customers.

Parcel carriers also have an order processing advantage over other motor carriers. FedEx Ground receives more than 95 percent of all packages via electronic manifest. When

manifests are communicated electronically, parcel carriers gain knowledge of shipments early and create more efficient loads. Additionally, parcel carriers have advantages in terms of accurate billing. Finally, parcel carriers capture the dimensions and weight of every package, whereas LTL carriers typically rely on customer input for weight and classification (Jindel, 2010).

Given the current state of the parcel shipping literature, additional study is warranted. The current study will extend the knowledge base by investigating the alignment of parcel carrier capabilities with the needs of parcel shippers. Poor alignment can result in resources being wasted on unneeded service elements while important service attributes go unfulfilled.

## METHODOLOGY

Maximum difference scaling (MD) is a discrete choice survey method that asks survey respondents to choose the most and least important items from a set of options. MD allows a large number of items to be traded off against each other in an efficient manner, which is independent of any rating scale bias. Additionally, MD produces a needs based segmentation, allowing priorities to be estimated for any subgroup (Cohen, 2003). Given these capabilities, it is well suited to the research objectives of this parcel shipping study. MD is gaining attention from academic researchers and practitioners (e.g., Cohen and Orme, 2004; Garver, 2009; and, Williams et al., 2011). Another study identified MD as the method that delivered the most valid results when conducting importance research (Chrzan and Golovashkina, 2006). Moreover, Garver et al. (2010) recommend MD as it has key distinct advantages over other methods, particularly rating scales. Traditional rating scales do not force choices, thus respondents may be free to select everything as important for example.

## Research Process

### Variables

To determine the appropriate attributes for parcel carrier selection, the carrier selection literature was thoroughly reviewed. Next, the researchers met with industry experts to make sure that the relevant attributes were identified and that these attributes were phrased appropriately. This process resulted in a final list of attributes that is aligned with the logistics academic literature, yet also has relevance to logistics professionals.

Once the list of attributes was developed, the researchers chose to include five attributes per MD survey question, a common MD best practice (Chrzan and Patterson, 2006). The next step in the MD experimental design stage was to determine the overall number of MD survey questions that should be presented to study respondents. Following the guidelines put forth by Garver et al. (2010), each research participant was asked 11 questions. The experimental design plan in the current study led to each attribute being shown approximately three times each to survey respondents.

The actual MD survey questions were developed after the experimental design plan was created, with each question containing the following instructions:

“Please consider how important different attributes are when selecting a parcel carrier. Considering only these 5 features, which is the Most Important and which is the Least Important?”

For each of the 11 MD questions, the research respondents were asked to select the “most important” and the “least important” attribute.

### Data Collection

Data for this study were collected from a business research panel. Members of the panel came from a leading market research firm called MarketTools. The choice to use an online panel as a data source follows numerous other supply chain and logistics researcher’s use of this

approach (e.g., Autry et al. 2008; Jack et al. 2010; Richey et al. 2010; and, Grawe et al. 2011).

When using online panels as a data source, researchers have taken a series of additional steps to validate knowledge and skills of respondents (e.g., Autry et al., 2010) and this study implemented those as well. First, MarketTools, was hired to provide the online panel. Second, filter questions were added to the survey in order to screen out panelists who did not fit the appropriate respondent profile. Figure 1 demonstrates how these individuals were eliminated from the respondent pool. As a result,

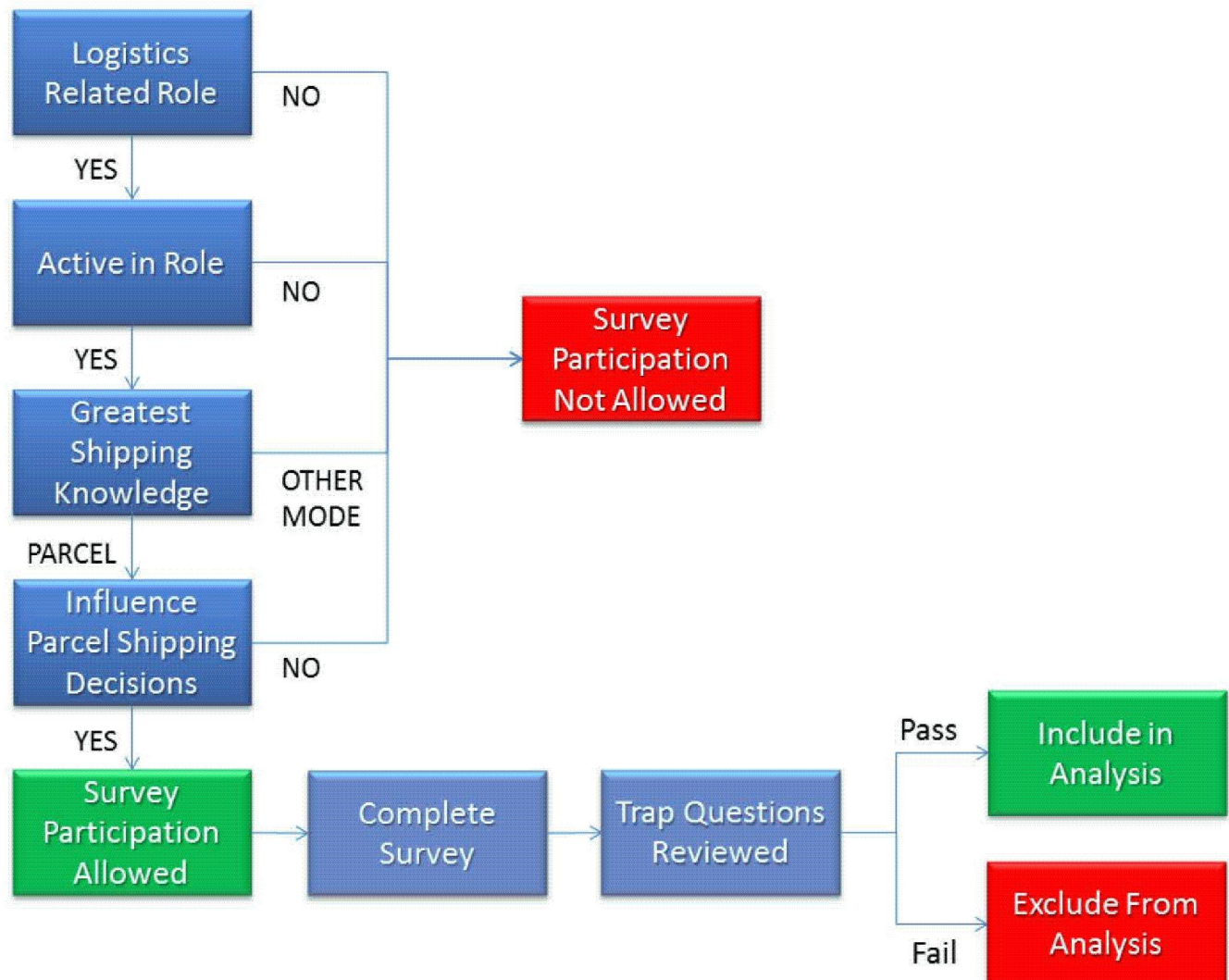
only logistics practitioners with extensive parcel shipping knowledge and buying influence are included in the final data set for analysis.

#### Data Cleansing

Four hundred twenty (420) completed surveys were collected. However, after excluding respondents with incomplete surveys, respondents lacking the necessary expertise, or those respondents who incorrectly answered embedded trap question, 374 valid and complete surveys were retained for analysis. When conducting MD research, a minimum of 100 data points are recommended

**FIGURE 1  
PARTICIPANT SCREENING PROCESS**

#### SCREENING CRITERIA



(Garver, et al., 2010). The final data set greatly exceeds this benchmark.

#### Data Analysis

Sawtooth software (7.0) was used to collect and analyze the MD data. Specifically, Hierarchical Bayes estimation was implemented to study the MD data. A MD study provides results which can be used to derive need-based segments, which is one of the objectives of the current study (Orme, 2005; Orme, 2005b; Garver, 2009; Garver et al, 2010).

### RESEARCH RESULTS

General properties of the sample will first be discussed, then the MD results will be presented. followed b

segments identified using latent class cluster analysis. Then, results from classification trees, ANOVA, and cross-tabulation analysis will be presented to describe the nature of each segment.

#### MD Parcel Selection Attribute Importance Results

A common practice in MD research is to rescale Hierarchical Bayes analysis results so that the importance scores assigned to all attributes sum to 100 points, with higher scores reflecting greater importance of the attribute. This means that the importance scores of one attribute should be interpreted in relative, not absolute, terms (e.g., an importance score of 10 is greater than 5, but not twice as great). Table 1 contains

**TABLE 1**  
**PARCEL CARRIER SELECTION ATTRIBUTE IMPORTANCE**

<b>Parcel Carrier Selection Attributes</b>	<b>MD Score</b>	<b>Cumulative MD Score</b>	<b>Rank</b>
Delivers shipments when promised	15.8	15.8	1
Transit time (speed)	12.1	27.9	2
Competitive rates	11.8	39.7	3
Picks up shipments when promised	11.5	51.2	4
Effective tracking systems	10.6	61.8	5
Availability of service	8.9	70.6	6
Ability to adjust to customer's needs	5.5	76.2	7
Invoice accuracy	5.2	81.4	8
Overall reputation of carrier	4.5	85.9	9
Security practices	4.0	89.9	10
Damage record	2.5	92.4	11
Financial stability	2.1	94.5	12
Website usefulness	1.8	96.3	13
Claims processing	1.5	97.8	14
Sustainability practices	0.8	98.5	15
Relationships with carrier personnel	0.8	99.3	16
Information sharing capabilities	0.7	100.0	17



the MD mean importance scores for the parcel carrier selection attributes.

Several observations should be made about Table 1. First, there is discrimination among the different parcel carrier selection attributes (Garver et al, 2010; Williams et al, 2011), with importance scores ranging from 0.68 to 15.77 (Table 1). Second, the scores of the six attributes having the greatest importance scores sum to 70.6, which means these collectively account for just over 70% of the total importance in parcel carrier selection by customers. Third, four attributes having greatest importance in parcel carrier selection – Delivers shipments When Promised (15.77), Transit Time (speed) (12.14), Competitive Rates (11.78), and Picks-up Shipments When Promised (11.46) – account for 51% of the total importance of attributes that influence the choice of parcel carriers by shippers.

Fourth, several attributes that have received much attention from practitioners and academics received relatively low importance scores. Specifically, security practices (4.0) and sustainability (.8) were ranked 10<sup>th</sup> and 15<sup>th</sup>, respectively, in terms of their importance in the parcel carrier selection process, while information sharing (.7) was the least important to business customers.

Finally, while mean responses are of some assistance in interpreting empirical results, they can be misleading (Garver, 2009; Garver et al., 2010; Williams et al., 2011). Garver (2010) suggested that researchers should examine need-based segments (if they exist) in order to truly understand customers in the marketplace. Accordingly, this analysis was next undertaken, the results of which are reported below.

### **Identification of Parcel Need-Based Segments** Latent Class Cluster Analysis (LCCA)

Latent class cluster analysis (LCCA) was used to determine whether meaningful, unique need-based segments exist in the sample used in this study. Research over the last decade has shown

that LCCA has distinct advantages over more traditional methods of cluster analysis (Vermunt and Magidson, 2005). Research has shown that LCCA has improved predictive capabilities over more traditional clustering techniques (Vermunt and Magidson, 2003).

Furthermore, LCCA assists researcher by supplying researchers with fit statistics that guide the selection of the appropriate number of segments. Finally, LCCA provides probabilities of segment membership, which is helpful in determining how well the technique has worked in segmenting the market (Garver, et al., 2008)

The researchers employed Latent Gold 4.0 to conduct the analysis. Each of the 17 MD parcel carrier selection attributes was entered into LCCA as continuous attributes to develop the segmentation results. Garver, et al. (2008) suggest that most segmentation studies examine up to five segments, since it is difficult for most practitioners to focus on more than five segments. With this in mind, the researchers ran the following cluster analysis models for consideration evaluation: a one cluster, a two cluster model, and so on. In total, six different models were evaluated (up to a six cluster solution).

The researchers used the random seed default in the program, which randomly selects ten different starting points for each analysis. This procedure overcomes the potential limitation of LCCA models to produce a local solution as opposed to a global maximum.

### **Number of Segments - Evaluation and Selection - LCCA**

The first goal of this analysis was to determine if need-based segments of parcel carrier customers exist, or whether the marketplace of parcel carrier customers is homogeneous in terms of the importance attached to the parcel carrier selection attributes. If the sample is homogeneous, then the interpretation of mean (overall) importance scores is valid. However, if need-based segments do exist, the first goal is to



determine the appropriate number of need-based segments. Selecting the appropriate number of segments is a critical task in LCCA.

Accordingly, the latent class model evaluation strategies identified by Garver, et al. (2008) were adapted for LCCA in this study. Similarly, the following “best practices” for determining the appropriate number of segments within LCCA were followed (Vermunt and Magidson, 2005):

- 1) Goodness of fit measures
- 2) Misclassification error
- 3) Theoretical knowledge, expertise, and researcher judgment.

#### Goodness of fit Measures

The BIC is the most popular goodness of fit measure for assessing LCCA models (Arunotayanun and Polak, 2011), especially when the data are sparse, the situation for most logistics research studies (Garver et al., 2008). One reason for this popularity is that the BIC measure simultaneously explains model fit while accounting for model parsimony. Typically, a model with a lower BIC value is preferred over one with a higher BIC value (Guerrero, Egea, and Gonzalez 2007; Wen, et al., 2012).

The researchers first specified and analyzed several models, estimating a 1, 2, 3, 4, 5, and 6-

segment model, using the 1-segment model as the baseline. If the 1-segment model has the lowest BIC score, then there is evidence that the parcel carrier market is homogeneous with respect to the importance placed on parcel carrier selection attributes. Table 2 provides critical results for evaluating model fit and selecting the appropriate number of segments.

Based on the goodness of fit measure, the 6-segment model is most appropriate as it has the lowest BIC value (17435). In contrast, the BIC measures for the 1, 2, and 3 segment models are significantly higher than that of the 6-segment model, yet the BIC scores for the 4 and 5-segment model are relatively close.

The classification errors provide strong support for a 4-segment model. By definition, a 1-segment model will have no classification errors. However, as the number of segments increase, so does the probability of classification errors. For example, all else being equal, a 4-segment model should have a higher classification error than a 3-segment model. However, in this study, the 4-segment model actually has fewer such errors relative to the 3-segment model. Additionally, the 5 and 6-segment models have relatively high classification errors, relative to 4-

**TABLE 2**  
**LATENT CLASS SEGMENT EVALUATION SELECTION**

<b>Number of Segments</b>	<b>BIC</b>	<b>Classification Error</b>
1 Segment Model	32111	0
2 Segment Model	29154	0.0162
3 Segment Model	28382	0.0268
4 Segment Model	28026	0.0265
5 Segment Model	27848	0.0415
6 Segment Model	27804	0.0436

segment model. Assessing classification errors lend strong support for a 4-segment model.

The fit indices and the classification errors result in a conflict concerning the appropriate number of segments. Thus, the researchers relied upon guidelines put forth by Garver, et al. (2008) as well as theoretical judgment to determine the appropriate number of segments.

From a practical standpoint, Garver et al. (2008) suggest limiting the number of segments to five or less segments. Aligned with practitioner guidelines, firms often have trouble on comprehending, understanding, and focusing on more than five segments.

From a theoretical standpoint, the 4-segment model has clearer theoretical implications for academic researchers and practitioners. After examining the 4 and 6-segments models the 6-segment model does not provide true theoretical differentiation among the segments. More specifically, the 6-segment does not truly show different segments, and the results are redundant. In addition, the 4-segment demonstrates more parsimony, a goal of all scientific endeavors. With this in mind, in addition to the classification errors, the 4-segment model was selected as most appropriate.

For the 4-segment model, each of the clusters was of substantial size and the parameter estimates demonstrate that each cluster has a unique and meaningful nature, because the values are significantly different across the other segments. The MD scores for the 4-segment model will now be explained.

### **Parcel Need-Based Segment Results: Unique and Different Segments**

At this time, differences among segments will be discussed first, followed by the actual size of each segment. Finally, attribute importance scores for each segment will be discussed, which will demonstrate the nature of each segment.

### **Unique and Different Segments**

Before the segment attribute importance scores are discussed, it is important to demonstrate that the four need-based segments are unique and significantly different from one another. To accomplish this goal, the Wald statistic is used within LCCA. As can be seen in Table 3, all of the 17 MD attributes show a significance level for the Wald statistic, which suggests that these 17 attributes are significantly different across the four segments and that these attributes are meaningful predictors ( $p < .05$ ) of driving segment membership. Essentially, each of the 17 attributes has a significantly different attribute importance score across the four segments.

In addition to the Wald statistics and related  $p$ -values,  $R^2$  values indicate the amount of variance that is explained by each parcel carrier selection attributes for each of the four different segments. The  $R^2$  values are a guide to suggesting which attributes are most important in determining segment membership. For example, the top five attributes that are the most important attributes to determine segment membership include:

- sustainability practices,
- transit time,
- financial stability,
- website usefulness, and
- information sharing capabilities.

Table 4 summarizes the importance scores for each attribute for each segment.

### **Overall View of the Segments**

Segment 1: The Essentials Segment

Segment 1 tends to focus on those critical attributes that are the foundation of parcel services. Segment 1 places the most importance on the following attributes.

- Delivers shipments when promised
- Transit time (speed)
- Competitive rates
- Picks up shipments when promised
- Effective tracking systems
- Availability of service

In addition, Segment 1 places significantly more importance on these attributes than other parcel carrier segments. Segment 1 is the most price sensitive segment, yet also placing the highest priority on transit time speed.

#### Segment 2 – Dependability Segment

While Segment 2 places high priority on the basics of parcel carrier shipping services

(delivered when promised, transit time, etc.), this segment is different from other segments because they place more importance on the following attributes:

- Availability of service
- Ability to adjust to customer's needs
- Invoice accuracy
- Overall reputation of carrier
- Security practices
- Damage record

**TABLE 3**  
**SIGNIFICANT DIFFERENCE FOR MD PARCEL**  
**CARRIER SELECTION ATTRIBUTES**

	<b>Wald</b>	<b>p-value</b>	<b>R<sup>2</sup></b>
Sustainability practices	166.3	0.000	0.45
Transit time (speed)	174.6	0.000	0.34
Financial stability	99.8	0.000	0.32
Website usefulness	168.0	0.000	0.29
Information sharing capabilities	92.9	0.000	0.29
Claims processing	113.3	0.000	0.25
Delivers shipments when promised	62.2	0.000	0.24
Security practices	114.1	0.000	0.22
Damage record	81.5	0.000	0.19
Relationships with carrier personnel	40.4	0.000	0.16
Competitive rates	49.3	0.000	0.12
Invoice accuracy	47.5	0.000	0.11
Effective tracking systems	41.8	0.000	0.10
Ability to adjust to customer's needs	43.3	0.000	0.09
Picks up shipments when promised	29.8	0.000	0.09
Overall reputation of carrier	17.1	0.001	0.04
Availability of service	9.1	0.028	0.03

Relative to other segments, Segment 2 places the highest amount of importance on issues that attest to the parcel carrier's overall dependability: availability of service, ability to adjust to customer's needs, invoice accuracy, and overall reputation of the carrier. In essence, Segment 2 is defined by these differentiating

attributes that engender customer trust in the carrier's important capabilities.

Segment 3 – Tech Segment

Segment 3 is very similar to segment 1, yet one key difference can be noted. Examining similarities first, Segment 3 places significantly

**TABLE 4**  
**SEGMENT IMPORTANCE SCORES**

<b>Parcel Carrier Selection Attributes</b>	<b>Segment 1</b>	<b>Segment 2</b>	<b>Segment 3</b>	<b>Segment 4</b>
Delivers shipments when promised	<b>16.7</b>	15.7	<b>16.5</b>	13.2
Transit time (speed)	<b>15.0</b>	11.1	<b>13.1</b>	7.0
Competitive rates	<b>13.9</b>	10.1	<b>12.9</b>	9.2
Picks up shipments when promised	<b>12.7</b>	11.0	<b>12.0</b>	9.0
Effective tracking systems	<b>11.9</b>	9.5	<b>11.2</b>	9.1
Availability of service	<b>9.4</b>	<b>9.4</b>	8.2	7.8
Ability to adjust to customer's needs	5.4	<b>7.0</b>	3.3	5.8
Invoice accuracy	4.6	<b>6.8</b>	3.7	<b>5.7</b>
Overall reputation of carrier	3.4	<b>5.3</b>	4.7	<b>5.3</b>
Security practices	1.8	<b>4.8</b>	3.4	<b>7.5</b>
Damage record	1.5	<b>3.5</b>	1.6	<b>3.9</b>
Financial stability	0.9	2.3	1.2	<b>5.4</b>
Website usefulness	1.5	0.2	<b>4.7</b>	1.5
Claims processing	0.8	2.1	1.0	2.5
Relationships with carrier personnel	0.2	0.2	1.2	<b>2.4</b>
Sustainability practices	0.2	0.6	0.4	<b>2.8</b>
Information sharing capabilities	0.2	0.4	0.7	<b>1.9</b>
<b>SIZE OF SEGMENT (%)</b>	<b>34%</b>	<b>29%</b>	<b>20%</b>	<b>17%</b>

higher importance on the following attributes, which is consistent with segment 1:

- Delivers shipments when promised
- Transit time (speed)
- Competitive rates
- Picks up shipments when promised
- Effective tracking systems

In addition, Segment 3 places significantly higher importance on “usefulness of the website” (4.7). Thus, given the significantly higher importance placed on tracking and website, the researchers conclude that this segment is more information driven.

#### Segment 4 – Balanced Segment

Segment 4 is very different from the other segments. First, Segment 4 possesses more balance in the importance placed on a wide number of parcel carrier selection attributes. Second, they place significantly more importance than the other segments on the following attributes:

- Overall reputation of carrier
- Security practices
- Damage record
- Financial stability
- Relationships with carrier personnel
- Sustainability practices
- Information sharing capabilities

Three observations can be noted. First, Segment 4 places much more importance on image related attributes such as overall reputation, financial stability, and track record of damage. Second, this segment places much more importance on recent trends such as sustainability and security. Finally, this segment is more information focused, placing higher importance on relationship with carrier personnel and information sharing capabilities.

## DISCUSSION

The results indicate that business parcel shippers consider the following attributes to be most important when choosing a parcel carrier: delivers shipments when promised, transit time, and competitive rates. While not significantly

important to all parcel shippers, a number of attributes were important in determining segment membership, such as sustainability practices, information sharing capabilities, and website usefulness. Latent class cluster analysis identified four different business parcel shipper segments that were based on the importance attribute of discernible variables. The resulting four-segment model, with its unique nature, was the most theoretically sound and parsimonious model of all models tested.

While there are significant differences in attribute importance, the results also indicate commonalities across segments. For example, the six most important attributes (delivers shipments when promised, transit time, competitive rates, picks up shipments when promised, effective tracking systems, and availability of service) are generally the most important attributes to each segment. However, concerning the six most important attributes, there are significant differences in the level of importance across the segments. Hence, the parcel shipping business should not be viewed as a single homogeneous market. Certain attributes are significantly more important to various segments that emerged among parcel shippers.

The Essentials Segment (Segment 1) focuses on basic performance considerations: delivering when promised, transit time, competitive rates, picks ups, tracking, and service availability. It is interesting to note that The Essentials is the most price sensitive segment, yet also places the highest priority on transit time.

Relative to other segments, the Dependability Segment (Segment 2) places the highest amount of importance on dependability concerns: availability of service, ability to adjust to customer’s needs, invoice accuracy, and overall reputation of the carrier. Likewise, the Dependability Segment places significantly more importance on their shipments being secure and damage free.

The Tech Segment (Segment 3) resembles The Essentials except that The Tech Segment places greater emphasis on website usefulness. Thus, given the significantly higher importance placed on website, the researchers conclude that this segment might be more driven by technology and information.

Regarding the Balanced Segment (Segment 4), this segment places much more importance on image related attributes such as overall reputation, financial stability, and track record of damage. The segment membership also places much more importance on recent trends such as sustainability and security. Finally, the Balanced Segment is more information-focused, placing higher importance on relationship with carrier personnel and information sharing capabilities.

## CONCLUSIONS

The findings in this research provide several valuable contributions to transportation literature. Parcel carriers transport a considerable volume of high value goods each year. Due to the growth and complexity of the parcel sector, carriers must have a greater understanding of business shipper needs in order to be successful. This includes the ability to objectively segment parcel customers into logical groups.

Latent class analysis is a quantitative approach that is useful in finding patterns of heterogeneity “related to characteristics of the choice situation and characteristics of the shipper” (Arunotayanun and Polak, 2011, p. 147) to identify segments of shippers (i.e., customers) that share a common logistics service profile. Latent class cluster analysis results stemming from this research categorized parcel shippers into four distinct segments and identified six important attributes (delivers when promised, transit time, competitive rates, picks up when promised, effective tracking, and service availability) that emerged among the different shipper segments. Academics and practitioners using the more common practice of treating

shippers as a homogeneous entity would have obscured these results.

Second, the empirical findings support the view that a one-size-fits-all (single segment) supply chain strategy cannot adequately meet all customer needs and expectations (Anderson et al., 1997). In addition, the findings illustrate opportunity for carriers (managers) to move beyond conventional service segments by taking a quantifiable need-based approach in understanding and managing shippers. Results indicate that there are segments of parcel shippers, like the Balanced Segment above, that are not as sensitive to time as other shipper segments, so perceptive carriers would benefit by designing an efficient logistics service operation that is reputable and secure and utilizes sustainable practices like consolidation to best serve customers.

These results are consistent with Barratt’s (2004) assertion that:

“If customers can be segmented by way of their buying behaviour and service needs, then separate supply chains can be designed to meet the specific needs of the various customer segments. Each supply chain will require a different strategy and a different culture to support that strategy” (Barratt, 2004, p. 34).

Carriers that accurately identify shipper segments can provide a “portfolio of services” that correctly meets the specific needs of each segment (Anderson et al., 1997). By predicting shipper desires and behaviors and placing shippers into optimal segments, carriers can adjust their marketing strategy, clarify their marketing message, and align their logistics operations to better target and serve each segment. Better aligned services have the potential to reduce operating costs and increase profit margins.

Third, recent research in logistics/supply chain management has called for using innovative, advanced research methods and statistical

methods. This study attempted to answer that call in several ways. First, maximum difference scaling (MD) was used to advance our understanding of the importance of a broad set of variables in terms of carrier selection. These results were then subjected to latent class cluster analysis and then to decision tree analysis. As a result of this multi-method analysis, the story that emerges from the data is different from prior research in this topic area. This represents an important step forward in understanding how shippers select motor carriers. Future research should examine logistics service models using MD attribute importance scores and latent class analysis to more accurately identify and address the unique needs of critical customer segments.

Future research is also needed to corroborate the different segments that manifested in this research. Furthermore, identifying additional attributes and descriptors for the different segments would provide better understanding of parcel shipper segments. The segment descriptors are key parcel carrier marketers being able to target different marketing mixes to each target segment, so further research is needed to better describe the demographic characteristics of each of these business segments. Other sectors of transportation service, namely truckload and LTL, might also consist of need-based shipper (customer) segments. Previous research has generally assumed that these sectors are homogenous, whereas this research and others like it (e.g., Arunotayanun and Polak, 2011) that examine shipper preferences suggest further investigation into possible heterogeneity.

In conclusion, while it is still of practical importance to pay close attention to shipment type (letter, packets, parcels, freight), volume, weight, route (e.g., residential, rural), haul length, and transit time; some shippers are more profitable than others as they are generally more willing to pay for high customer service that fulfills specific needs. This study has illustrated that parcel shippers are not homogenous. Rather, four distinct parcel shipper segments emerged based on specific needs expressed by the shippers.

Identifying and understanding these customer segments may provide carriers with an advantage in negotiations with shippers who value service characteristics beyond cost. Furthermore, shipper needs may change over time, just as the business environment can change (e.g., JIT, Hours of Service, and home delivery), causing carriers to adjust their strategy and approach (Meixell et al, 2008). Consequently, supply chain executives and leaders must understand shipper segments to provide optimum customer service that continues to meet if not exceed shipper needs and expectations.

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